AN AGRICULTURAL STUDY OF ASIA MINOR

by

Ali Nouman

Graduate, Halkali Agricultural College (Turkey), 1914

A THESIS

submitted in partial fulfillment of the

requirements for the degree of

MASTER OF SCIENCE

KANSAS STATE AGRICULTURAL COLLEGE

1929

Document
LD
2668
.T4
1929
N62
c.2

Table of Contents

Geographic Position and History of Asia Minor 3

Geological and Paleogeographical Asia Minor.. 11

Climate.. 13

Soils of Asia Minor.. 41

The Alkali Problem in Asia Minor.......................... 56

Potassium Nitrate Accumulation.......................... 58

The Distribution of Vegetation in Asia Minor.. 59

The Forests.. 59

Sea Shore Climate Vegetation.............................. 66

Effect of Three to Four Thousand Years of Cropping on the Soil.............................. 68

Agricultural Regions of Asia Minor........................ 71

Nitrogen Problem and Leguminous Crops in Rotation.. 83

A Wheat Breeding Program for Asia Minor................ 93

Farming Conditions in Asia Minor......................... 96

Methods of Field Management in Asia Minor.............. 98

The Possible Adaptation of American Dry-Farming Methods to Dry-Plateau of Asia Minor...............100

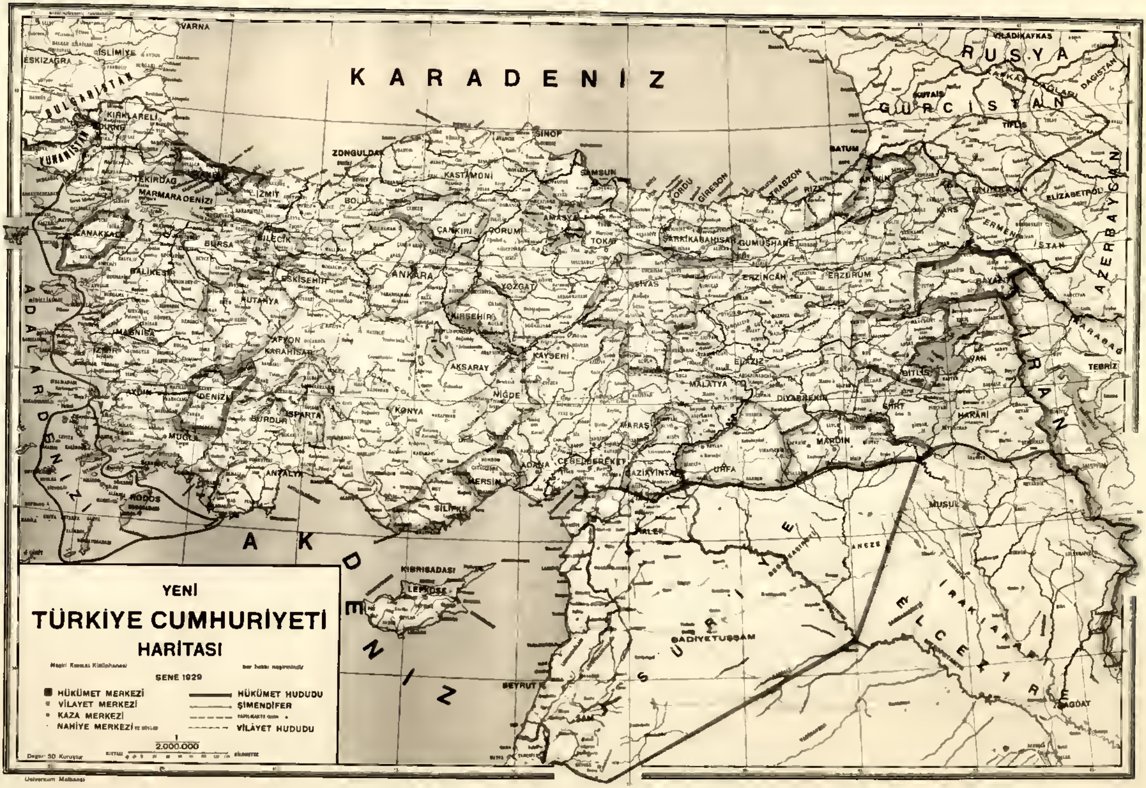
GEOGRAPHIC POSITION AND HISTORY OF ASIA MINOR

Geographic Position

Asia Minor is a peninsula located in the western part of Asia. It is surrounded with the Black Sea on the north, the sea of Marmora and the Aegean Sea on the west, the Mediterranean on the south, together with Syria and Mesopotamia. To the east there are the borders of Persia and the three Federal Transcaucasian Socialist Soviet Republic of Azerbaygan, Armenia, and Georgia. This territory lies between 36° 30' and 42° north latitude and between 26° 30' and 43° east longitude. The area comprised in these boundaries is 273.808 square miles which is approximately equal to the three Great Plains states, Kansas, Nebraska, and Colorado.

Mountains and high plateaus characterize Asia Minor. Mountain ranges surround it, at elevations ranging from 5,000 to 10,000 feet. The Pontus mountains border the Black Sea. The Asiatic Olympus, Uludag, 7,000 feet in altitude and the ancient Ida, today called Kazdag, are near the Marmora and Aegean Sea.

Other western ranges are not parallel to the Aegean Sea. There are valleys and mesas between the mountains comprising them. On the south the Taurus mountains border the



YENİ

TÜRKİYE CUMHURİYETİ HARİTASI

Naşiri Kanaat Kütüphanesi

her hakkı mahfuzdur

SENE 1929

Değeri 50 Kuruştur

Üniversum Matbaası

Mediterranean seashore and then turn inland to the northeast forming the Anti-taurus, the backbone of Asia Minor. In some places the Taurus and Anti-taurus mountains are 10,000 feet high, a condition which is of great influence on the climate of Asia Minor.

The elevation of Asia Minor increases from west to east, reaching the highest point at the Russian and Persian boundary. Here is Mt. Ararat, 18,000 feet above sea level. In this peninsula are other mountains such as Arjias near Kayseri which is 12,850 feet in altitude.

The center of the peninsula is a high plateau, about 2,000 to 5,000 in elevation. There are larger dry plains, alkali desert, marsh lands and some rolling land with fertile valleys, but all are treeless. Four streams form the drainage system to the Black Sea. Of these, Kizilirmak (Red River) ancient name Halys, is the largest and greatest. It carries soil from the dry up-lands to the Black Sea. The length of the river is 520 miles.

Yeshil (Green River) ancient Iris, and Charuk river flow to the east of the Kizil river. These latter rivers are used for irrigation purposes. The banks of the Yeshil especially are lined with water wheels. Some of them carry 100 tons of water per hour, which is equivalent to an acre inch of water. The waters of the Yeshil are not alkaline.

The Kizil, however, except in eastern sections is not used for irrigation purposes because of an injurious amount of alkali.

Sakaria (ancient Saugarius) is a secondary river but important to the dry plateau region because in passing through the northeastern portion it forms alkali land.

On the side of the Marmora and Aegean Sea (western slope) the Susurlu river drains all northeastern mountains with their many fresh water lakes to the sea of Marmora. This river and its branches occupy a large basin. Many attempts have been made to reclaim this land for agriculture. If the basin lake and marshy land were drained and floods controlled, a number of acres of fertile land could be brought under cultivation.

The Kediz (ancient Hermus), Kuchuk menderes (small) and Buyuk menderes (large) are important rivers in productive sections of Asia Minor. They flow to the Aegean Sea and drain about all of western Asia Minor. The mountains are forested but the valleys are subject to flooding. In 1928 the Turkish government expended $50,000,000 for agricultural reclamation in this fertile section. It is estimated that 10,000,000 acres of very fertile land can thus be safeguarded and irrigated.

When a severe drought occurred in 1928 throughout the Asia Minor plateau, the Turkish government was in doubt whether to provide irrigation and flood control for the fertile valleys of the Smyrna region on the west, or to finance irrigation on the dry up-land plateaus. It was decided to make expenditures to increase this productivity of the fertile Menderes valleys. This section has a pleasant temperate climate and produces long lint cotton as well as other important crops.

On the Mediterranean slope of the Asia Minor plateau, there are two streams of agricultural importance, the Seyhan and Jeyhan. These two streams drain the waters of the lofty Anti-taurus mountains to the Mediterranean Sea. They pass through the Cilician plains, an important cotton district.

The Persian Gulf or Southern slope of Asia Minor carries two streams, the Furat (Euphrates) and the Digle (Tigre). These streams are important to Mesopotamia. The two rivers in the eastern highland are used for irrigation and transportation. Some of the rivers that flow through dry plateau regions are dry in the summer. But those connected with inland lakes carry water throughout the year.

During the tertiary period of geology, most of Asia Minor was an inland sea. This sea water was somewhat salty; during the same period a similar inland sea occurred in the United States, Lake Bonneville in the southwest Great Basin of Utah. At the present time, both places have salty lakes. Great Salt Lake in Utah, and Tuzgul (Salt Lake) ancient Palus tattaous, in Asia Minor. The Pacific coast region of the United States and the Mediterranean shores have similar characters in both paleogeographic and the present times.

The central plateau region is characterized by a large salt lake containing as much as 35 per cent sodium chloride in its water during the summer period. Evaporation causes this concentration. The salt from the lakes is used for cooking purposes and yields 19,000 metric tons annually.

The most important lake in this region is a fresh water lake, Beyshehir lake. Its waters are used to irrigate the great plain of Konya. This irrigation project in Asia Minor was carried out in 1907-1913 by the Bagdad Railway Co. Other lakes are not important agriculturally but require reclaiming because of harboring mosquitos which endanger the surrounding population with yellow fever.

In northwestern Asia Minor there is another fresh water lake region near the sea level. This region affords opportunities for reclamation by drainage, since the soils are fertile and located in an important agricultural locality. The largest lake in the northeast is Van Goli, occupying 1,425 square miles. Because of its salty waters, it is not agriculturally important.

History

Asia Minor has been occupied by Turks since the 10th century. It is more of a fatherland to this race than the country in which they originated, namely, Central Asia and Turkestan. When the Ottoman Empire was dissolved after the World War, the Turks made the greatest concentrated effort of their whole history to keep Asia Minor as their fatherland. By their struggle Asia Minor was consolidated into the new Turkish Republic.

In ancient times, Asia Minor was the highway for ranks between the east and the west. The country was then ruled by various conquering races and unsocialistic nations, such as the Persians, Egyptians, by the Greeks under Alexander, and by the Romans, the Turks and the Crusaders. During these various periods there was much immigration and occupation with shifting of the population when the rule changed from one race or nation to another. However, some of the population remained in local places, retaining their language and traditions. When the Turks came from Turkestan (Central Asia), they occupied the whole country but kept the former inhabitants. This was done in order to have food produced for their flocks and horses, the Turks being a nomadic race. They found the climate and conditions very favorable. There were large grazing lands for their sheep and other animals, while the surrounding country was fertile. Here they flourished.

Thors are inscribed monuments in Asia Minot that the Hittites were among the ancient races of the country and no doubt some of the local races are descended from them.

Strabo, a famous ancient geographer, discussed the system of farming in Asia Minor, an old eastern system which is still used today.

Effect of Climate on Human Life in Asia Minor

Climate has a marked effect on the degree of civilization that takes place in the devlopment of a race. This is clearly seen in the present dry climate of Asia Minor. Strabo described the dry plateaus 2,000 years ago, and the same description applies today. He mentioned sheep and wild asses on the Konya plain. At the present time there are flocks on this same plain, but the wild asses are now domesticated. Strabo also mentioned the treeless condition of the plateau as it is at present. Some foresters have stated that the dry condition of the plateau was due to the destruction of trees, but this is contrary to Strabo's record.

The ancient farmers raised millet on this dry plateau.

Strabo stated it to be a very drought resistant crop under this condition.

Races develop in civilization when occupying a pleasant climate and fertile soils, or land easily irrigated. This has occurred in Egypt and Mesopotamia. Dry conditions keep the population in a nomadic state. In such climates we find nations of sheep, cattle, and horse raisers. Thus Asia Minor was inhabited by a population of sheep raisers.

There were, however, some large and important ancient cities in Asia Minor, like Anciry, Iconium, Mazda, and Amasia. These cities were built under exceptional conditions. For instance there was a need to keep the old trade highways between the east and the west. All of the important cities were built upon this highway. In the case of Amasia, a peculiar typographic position determined its location, in the way of affording an unconquerable fort.

These cities were densely populated under ordinary conditions, but during the hot summer time the people removed to the country, frequently 10 to 20 miles away. During the summer the social and commercial life of the city stopped. The flocks were moved to high, forested elevations, leaving many villages temporarily empty. About 70 to 100 years ago, the Ottoman government domesticated all nomadic tribes in Asia Minor by compulsory law.

At the present time nomadic tribes occupy the eastern mountain region. The Asia Minor farmers are raisers of crops and flocks. Perhaps this method will be used until the population increases and lands are put under irrigation.

The ancient people were interested in irrigation but not on a large scale, as in Mesopotamia. Only one attempt of this kind was made and that was during the early centuries. One Capaducian king wanted to make a long dam with an artificial lake near Halys (Kizil river). The project was attempted. The dam broke and the population and all crops were destroyed.

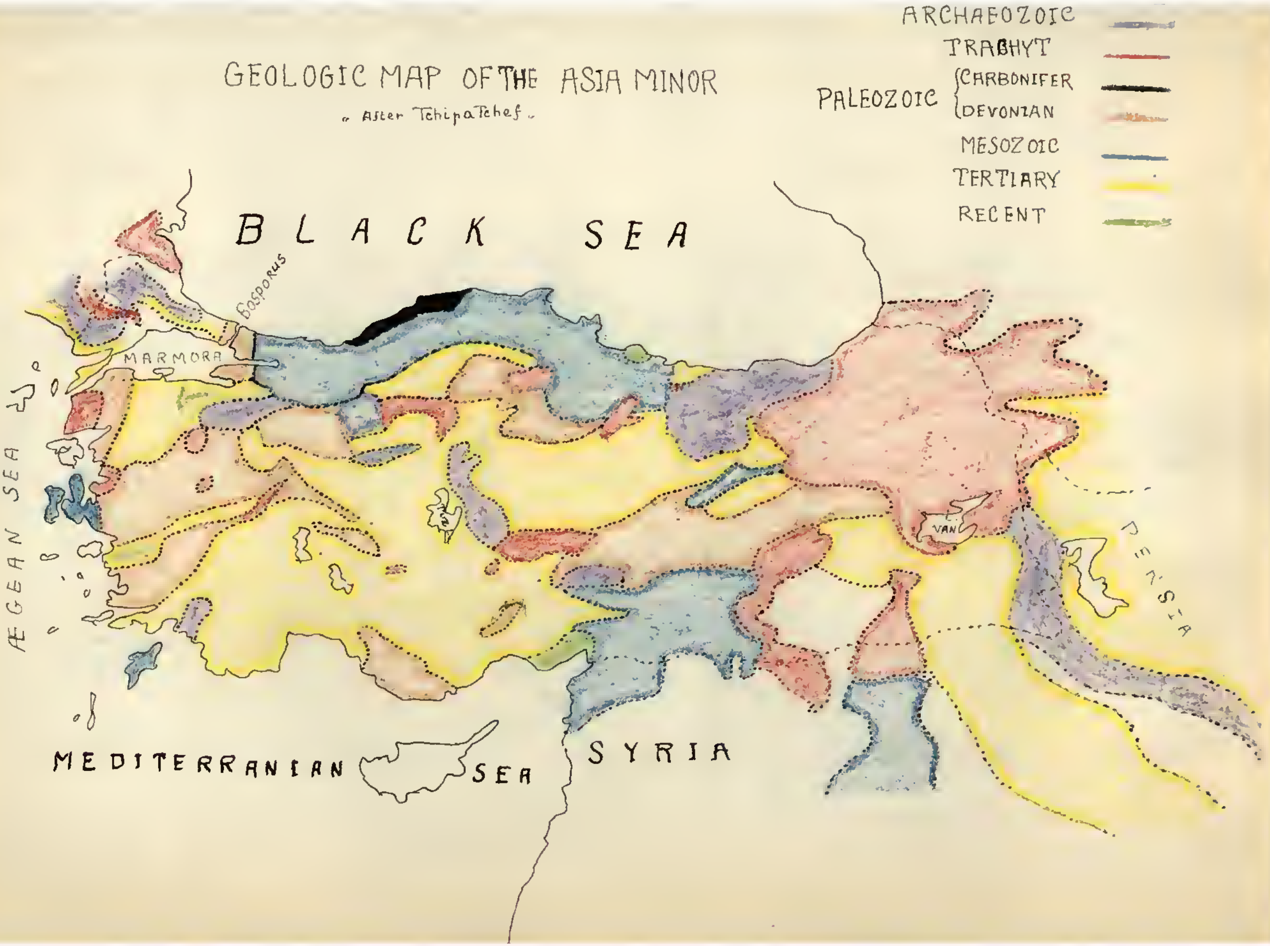
GEOLOGICAL AND PALEOGEOGRAPHICAL ASIA MINOR

The geological formations of Asia Minor are largely those of the tertiary period, although other periods are represented. Earthquakes about sea shores have caused both submergence and elevation of lands in that region.

The Taurus mountains and all of the eastern mountain region developed during the Miocene tektonic period, similarly as the Alps in Europe and the Rocky mountains in the United States. The Black Sea mountains were formed during cretaceous times, and there are Devonian formations in the Bosforus area. The Smyrna region was not affected by the Miocene tektonic formation.

GEOLOGIC MAP OF THE ASIA MINOR

« After Tchipatchef »



On the western Black Sea shore there is a small area of carboniferous formations and much lignite coal in the tertiary beds.

Igneous trachyt rocks predominate in the eastern mountain and in the great plateau regions. These volcanic formations were active probably until the close of the tertiary period. In the central plateau, the lofty Arjis mountain was formed during this time. It has an elevation of 12,650 feet and is located near Kayseri.

The Black Sea shore mountains run parallel to the coast. They are formed of serpentine rocks and limestones that developed during early Archaic and cretaceous periods. Some Archaic rocks are found at the Asiatic Olympus, near Marmora Sea in northwestern Anatolia, and gneiss, a metamorphic rock, in the central plateau region.

Along the Aegean seashore and some distance from the coast there are zones of serpentine and crystalline schistose rocks and coniferous limestones. These belong to Devonian formations of Paleozoic time. They meet in the Taurus mountains which run west to east. In this mountain chain there are Archaic rocks and cretaceous limestones that developed during the Paleozoic period. However, certain formations belong to the tertiary Eocene period. The accompanying maps show the geological formations in Asia Minor.

CLIMATE

Observations of climatical conditions in Asia Minor have been made at various times and places, but these observations were not with agricultural objects in view. The records were made with different instruments and hence the data are not reliable. However, the Turkish department of agriculture reorganized all meteorological stations four years ago and established a weather bureau. New stations in various parts of the peninsula were organized in connection with the military air corps and the department of forestry. Last year the Angora weather bureau published daily forecasts and also broadcasted them by radio. Relations are maintained with the European meteorological stations. This thesis refers to the climatic data accumulated by the reorganized weather bureau. However, recourse has been made to old data that are important to our study of drought conditions. Data are available from 1908 by the Anatolia railway stations and by the Angar agricultural school.

Climatical Peculiarities of Asia Minor

Asia Minor has a climatical condition unlike that of other Mediterranean countries that are situated in the same degree of latitude. The climate is drier and colder in winter. This is because other Mediterranean countries are protected from the cold north winds by high mountains like the Alps, the Pyrenees, and the Balkan mountains. But Asia Minor is exposed to the north winds that sweep down from the unprotected Russian steppes.

Mountains play a very important part in determining the climate of a region. In northeastern Asia Minor, under the lofty Caucasian mountains, there is a very large precipitation, amounting to 100 inches. This does not occur in any other place in Europe. Here there is a subtropical vegetation of tea, and all varieties of oranges.

On comparing January temperatures of different Mediterranean countries we find that Palermo in Italy has a mean temperature of 50.5° F.; Athens in Greece, 46.3° F.; and Smyrna in Asia Minor, 45.8° F. All of these places have the same latitude and are on the seashore.

In the summer, Asia Minor is affected with the Persian Gulf low depression winds, which blow from the west to the east from the seashores. Inland the winds are from north to south. But these winds are mild and not moist.

The Asia Minor plateau tempers the climate of the seashores. For example, in the winter time, the central plateau has a mean temperature of 5.6° C. and the Mediterranean shows a temperature of 10° C.

In the winter time, the prevailing winds blow from the north to the south. With a temperature of 10.8° F. on the plateau the cool winds passing south over and down the Taurus mountains separating the plateau from the seashore are tempered to 27.8° F. when they reach the sea plains. The average elevation throughout the plateau is about 3,200 feet. With every drop of 182 feet in altitude there is a drop of 1° F. in temperature. Thus the sea plains which have a mean temperature of 50 F. are cooled with the north winds.

In the spring there is a converse effect on the sea plain from these north winds. For instance, in April the central plateau has a temperature of 52.5° F. The winds passing from the plateau to the seashore raise the temperature of the latter 17° F., creating a temperature of about 70° F. on the seashore plain. This effect is similar to the Chenook winds in the Great Plains region from the Rocky mountains.

The moisture bearing winds on the south seashore plain are from the Mediterranean Sea, bordering it on the south. When these winds reach the Taurus mountains to the north, they have lost their moistrre. Thus the central plateau, separated from the sea plains by these mountains, cannot receive moisture from south winds. Consequently the driest part of the central plateau is near the Taurus range. A similar condition prevails in the dryland regions of eastern Washington and Oregon in the United States. The Cascade and Rocky mountains on the west and east respectively exhaust the winds of moisture in this region.

Winds play an important role in the distribution of moisture. In Asia Minor, the moisture bearing winds come from the Aegean sea on the west, passing over the central plateau. The western mountains run at right angles to the Aegean sea. This permits the moisture carrying winds to pass through the valleys to the central plateau. Accordingly the western part of the plateau receives more moisture than the eastern and southern parts. The western area near the Aegean sea receives 20 to 30 inches of annual rainfall. The western plateau receives 14 to 15 inches and the southern plateau six to eight inches.

Climatical Zones in Asia Minor

Asia Minor is not a large continental area like the United. States, yet its mountainous character causes considerable variation in the climate of its various regions.

The Central Plateau

About one third of whole area of Asia Minor comprises the central plateau. It has a winter and spring type of rainfall and also the coldest winters of the peninsula, except in the high mountains in the eastern region, comprising Armenia or Kurdistan. The central plateau has an elevation of 2,000 to 5,000 feet and forms a tableland called the Konya plain and Haymana steppe. Some of this section is rolling or hilly and treeless except for local pine forests or growth of juniper. Here the rainfall is eight to 15 inches. The rate of evaporation is high. Table I compares the evaporation at Ankara,with an elevation of 2,600 feet, with that at several points in the Great Plains region and in the northwest dryland region of the United States.

Table I.--Comparative Evaporation in Asia Minor and U. S. Dry Land

	Foch Atmometer (inches)	Free Water Surface (inches)			
	2 years	6 years	12 years	4 years	1921
	Angora	Moro	Nephi	Hays	Tribune
April	5.52	4.65	4.219	4.85	8.087
May	7.82	6.57	6.775	5.59	11.445
June	10.28	8.16	8.934	6.88	9.589
July	10.64	7.71	9.662	9.22	11.968
August	11.98	8.35	9.050	8.60	10.672
Sept.	7.72	4.63	6.330	8.02	8.685
Oct.	6.95	2.81	3.403		7.410

As noted in Table I, the data for Ankara are based on the use of the Pech atmometer while the data from the United States is from a free water surface. Consequently the data are not comparable but are of interest. Apparently the evaporation conditions at Ankara, Hays, and Tribune are somewhat similar. The fall evaporation at Moro, Oregon, and Nephi, Utah, is less than that at Ankara.

Comparisons of the average mean temperature by months at Ankara and at dry land regions in the United States are made in Table II. Approximately the same mean temperatures prevail at these points. Within the central plateau of Asia Minor there are variations from the mean temperature as shown at Ankara. This is illustrated by Table III.

The most rain occurs in May. This is very important for the crop production of the plateau region. The fall is usually a dry season. The first rains come in November. The rains fall slowly except in June when thunder showers may occur. At this time there may be heavy downpours amounting to as much as one inch falling in 10 minutes. Crop destroying hailstorms and local floods also happen during June. At this time of the year the rains are local in character.

Most of the rains fall during the afternoon. During the spring and summer rains rarely occur at night. The pla-

Table II.--Average Mean Temperature by Months

	1920-1908	1920-1911	1920-1911	25 yr.av.	25 yr.av.	1920-1908
	Nephi (Utah)	Moro (Ore.)	Lind (Wash.)	Manhattan (Kan.)	Hays (Kan.)	Ankara (Asia Minor)
Jan.	---	30.2	30.1	29.0	29.8	27
Feb.	---	33.2	32.5	31.2	31.0	29
March	---	41.2	41.1	43.9	42.3	40.6
Apr.	45.1	47.1	50.9	54.5	51.8	49.1
May	53.6	52.8	58.5	64.5	61.6	54.1
June	63.7	61.5	65.3	74.5	71.9	62
July	71.4	68.1	73.7	73.5	77.9	73.3
Aug.	70.2	67.5	73.7	77.9	77.2	68.3
Sept.	60.9	54.9	62.3	70.9	68.3	62
Oct.	47.3	48.4	51.7	57.7	56.0	53.8
Nov.	---	39.5	39.6	44.1	42.2	45.5
Dec.	---	31.5	30.6	31.3	30.8	28

Table III.--Mean Temperatures at Various Locations within Central Plateau of Asia Minor

Locations	Elevation (feet)	Mean Temperature in Degrees Fahrenheit	
		Warmest Summer	Coldest Winter
Ankara	2,600	73.3	27.3
Eskischir	2,350	73.0	28.1
Konia	3,460	66.9	22.0
Sivas	4,250	63.3	26.8
Merzifon	2,500	66.0	30.6
Afion	3,350	66.4	35.5

tead farmers at Asia Minor are happy when there are slow continuous afternoon rains during the spring. When this happens the rains are called forty afternoon rains.

There is a close correlation between crop yield and spring rainfall in Asia Minor. The comparative amount of spring rainfall at Ankara and at dry land regions in the United States are shown in Table IV.

As an example of the correlation between spring rainfall and crop yield, we can cite results obtained at the Ankara farms in 1926 and 1927. In 1926 there was a rainfall of 4.3 inches during the fair spring months and the crop yield from summer fallowed land was 15.5 bushels per acre. In 1927 with 2.7 inches of rain during the same spring months, the yield was 4.6 bushels per acre.

Table IV.--A Comparison of Average Spring Rainfall at Ankara and Dry Land Regions in the United States

	Hays (Kan.)	Hays 1917 dry yr.	Tribune (Kan.)	Lind (Wash.)	Moro (Ore.)	Nephi (Utah)	Ankara (Asia Minor)
March	.99	0.07	.58	.57	.81	1.61	1.21
April	2.32	1.96	2.34	.97	.77	1.34	.96
May	3.29	1.72	2.39	.87	.91	1.70	1.86
June	3.20	2.15	2.95	.29	.55	.57	1.36
	9.80	5.90	8.26	2.70	3.04	5.22	5.39

From April to September the observed radiation hours at Ankara have been 1,829.9. At Dodge City, Kansas, the radiation hours for the same period are 1,738.

The wind velocity at Ankara is comparatively low being about 5.5 miles per hour on the average. The maximum wind does not exceed 11 miles per hour. The prevailing winds are from the northeast and when strong winds occur they are from the west.

There are a few months from April to November that are frost free. The first killing frost occurs in November and the last killing frost in the spring is in April. Occasionally the last killing frost happens in May.

During December, January, and February, the precipitation comes in the form of snow. The snow does not remain long on the ground. Most of the rains are small in amount. In the winter and early spring, with low evaporation, this is not an important fact, but when evaporation becomes high, this is a serious drawback unless the small rains are frequent. In the Great Plains of the United States, when high rates of evaporation prevail, a rainfall of 0.5 of an inch may not be effective on plant life. But in Asia Minor, when small rains fall every day in the spring, the farmers raise good crops. For example, in March, 1926, 2.6 inches of rain fell during 20 days and yet there was only one day when the rainfall exceeded 0.5 of an inch. In May of this same year the rainfall was 0.9 of an inch for 14 days and the largest rain did not exceed 0.23 of an inch. It is an exceptional year when more than an inch of rain falls in one day. In Table V there is a comparison of the amount of rainfall during the fair seasons on the central plateau. In comparison with these data, Table VI shows the precipitation in the dryland sections of the United States for the same seasons.

Table V.--Amount of rainfall during the fair seasons on the central plateau of Asia Minor

Region	Inches of rainfall				
	Spring	Summer	Fall	Winter	Total Amount
Bilecik	4.85	3.4	2.68	3.5	14.4
Affion Karahisar	5.90	4.5	1.88	1.48	14.1
Eskischir	5.90	2.1	2.28	2.68	12.9
Ankara	4.00	1.68	1.48	2.70	10.0
Merzifon	6.60	3.75	3.75	3.25	17.0
Sivas	5.85	1.32	4.4	4.7	16.2

Table VI.--Amount of rainfall during the fair seasons in dryland regions of the United States

Region	Inches of rainfall				
	Spring	Summer	Fall	Winter	Total amount
Hays, Kan.	6.60	9.41	5.02	2.13	22.61
Tribune, Kan.	5.31	7.75	2.13	1.31	16.50
Nephi, Utah	5.02	2.03	3.11	3.44	13.61
Moro, Ore.	2.49	1.03	3.73	3.48	11.97
Lind, Wash.	2.01	1.25	1.87	2.56	7.68

Black Sea Shore

From Batum to the Bosporus there is an area 750 miles long and 60 to 100 miles wide, continuing on to the Black Sea Shore. It is not agriculturally important because of its mountainous character. However, there are forests and some orchards, especially in the northwestern section. The Caucasian mountains play an important part on the climate in northeastern regions. Here they have occasioned a subtropical climate with an annual precipitation of 100 inches at Batum, latitude of 42°. The winds come from the west. As they raise over the Caucasian mountains they drop all of their moisture on the western slope. In Table VII the mean, maximum, and minimum temperatures of this region are recorded.

The seasonal precipitation for different places in the Black Sea area is presented in Table VIII.

Table VII.--Mean, maximum, and minimum temperatures in the Black Sea region

Location	Temperature in degrees Fahrenheit		
	Mean Yearly	Maximum in July	Minimum in January or February
Batum	57.7	74	41.0
Trakson	58.4	75	43.7
Zonguldak	56.8	73	40.0
Constantinople	56.8	73	39.9

Table VIII.--Season precipitation for different places in the Black Sea area

Location	Inches of rainfall				
	Spring	Summer	Fall	Winter	Total Amount
Batum	14.3	22.8	35.0	28.0	100
Trabzon	7.45	6.1	11.1	9.2	34.6
Samson	7.3	3.4	9.05	9.2	29.0
Sinop	4.3	5.0	9.70	8.5	27.4
Constantinople	5.35	4.1	8.70	11.1	29.2

Western Anatolia Region

Western Anatolia comprises the region between the Aegean sea and Marmora sea. This area is under the effect of the Etesian wind. This northern summer wind causes a pleasant summer climate.

As mentioned previously, the western Anatolian mountains are perpendicular to the Aegean seashore. The valleys and plains between the mountains thus permit an extension of this area. In the winter time, the winds are from the west and carry moisture which penetrates 200 miles inland until the plateau region is reached.

The two winds, the Etesian and the west moist wind govern the climate of the region. When the Etesian winds blow from May to October, there is dryness, there being winds from the north. Table IX shows the seasonal rainfall and temperature of this region. Here there are about 200 days of a frost free period. Cotton and grapes are raised in the whole area and figs, Sultana raisins, and oranges in the Smyrna region.

Table IX.--Seasonal rainfall and temperature in western Anatolia

Location	Rainfall in inches					Temperature in degrees Fahrenheit		
	Spring	Summer	Fall	Winter	Total Amount	Mean Yearly	Mean Max. in July	Mean Min. in Jan. or Feb.
Aydin	6.0	0.65	2.9	15.0	25.0			
Smyrna	6.2	0.80	5.2	12.6	25.5	57.5	80.5	45.8
Kepsud	3.5	0.50	5.0	14.4	23.5	55.0	70.0	39.0

Mediterranean Sea Region

The Cilician plain forms the eastern part of the Mediterranean sea region. It is very important agriculturally. Cotton and wheat are produced very extensively. The Taurus mountains are determining factor on the climate. They protect the Cilician plain from the cold western wind and expose them to the warm southern wind.

This region has the highest winter temperature in Asia Minor. During the summer the temperature goes up to 100° F. for several days, especially in the first week of August. Although the south wind is extremely hot, coming from the Arabian desert, the farmers desire it in order to have the cotton bolls open. Table X shows the mean temperature and seasonal precipitation of the Mediterranean sea region.

Table X.--Seasonal rainfall and temperature in the Mediterranean sea region

Location	Rainfall in inches					Temperature in degrees Fahrenheit		
	Spring	Summer	Fall	Winter	Total Annually	Mean Yearly	Mean Max. in July	Mean Min. in Jan. or Feb.
Adana	6.9	0.96	5.2	11.3	24.4	66.5	82.5	47.8
Antalya	6.8	0.70	10.6	16.3	34.4	64.0	81.0	49.2

During the fall and spring the days are usually foggy until noon, then the skies clear. There are about 200 frost free days. In this region there is a wheat rust problem.

The summer months including September are dry. Winter crops are often sown in dry seed beds, similar to the plateau conditions at seeding time. Conditions here differ from the plateau in that no injurious effect follows the sowing in dry seed beds. This is because the winter temperatures are not so low and are high enough to allow the wheat to make some winter growth. On the plateau there is often an injurious effect because late drought prevents germination of the seed and plants newly germinated may be killed by low temperatures.

Southeastern Asia Minor Region

The north side of this region is surrounded by high mountains, but the southern side is exposed to the Syrian desert and to Mesopotamia. The elevation decreases from north to south and from west to east. The fluctuation between summer and winter temperature is high because the character of climate has been changed. This is not a sea climate but a steppe climate. The spring and fall temperatures are the same as other Mediterranean regions while the summer is hotter and winter colder. A comparison of temperature with the Mediterranean region is presented in Table XI.

Table XI.--Mean temperatures of southeastern Asia Minor compared with those of Silician plain

Location	Temperature in degrees Fahrenheit		
	Mean Yearly	Mean Maximum during hottest Months	Mean Minimum during coldest Months
Adana	66.5	82.5	47.8
Urfa	64.6	89.0	39.6
Musul	68.2	97.0	41.1
Diyarbekir	61.0	93.0	30.3

If we compare this region with other hot Mediterranean regions, Cairo in Egypt, for example, we find a wide difference in the two regions, but the latitudes are not the same. Diyarbekir has a latitude of 37° 50' and Cairo, 30° .05' north latitude. The comparative temperatures are as follows:

	Summer temperature	Winter temperature
Cairo, Egypt	82.5° F.	53.6° F.
Diyarbekir, Turkey	93.0° F.	30.8° F.

Sometimes the winters are extremely cold. In 1906 Diyarbekir and Musul had a very severe winter; the mercury then went down to 0° F. The amount of precipitation decreases from west to east and from north to south. The seasonal rainfall data are given in Table XII.

Table XII.--Seasonal rainfall in southeastern Asia Minor

Location	Rainfall in inches				
	Spring	Summer	Fall	Winter	Total Amount
Diyarbekir	7.2	1.0	1.80	9.7	19.7
Maras	7.5	0.92	3.60	9.5	21.2
Urfa					15.9
Musul					12.4

Eastern Mountain Region

This mountainous region has an elevation of 4,500 to 7,000 feet. It is the livestock center of Asia Minor, having plains and valleys that produce small grains. The mountains for the most part are treeless. The elevation increases from west to east, forming the loftiest peaks in Asia Minor. Mt. Ararat has an altitude of 18,000 feet. There is practically no spring and fall in this region, but a long winter and a short summer. The winters are extremely cold. In some years, from December to March, the ground is covered with snow, and the temperature goes down to 26° F. At Erzurum the mean temperature in April is 46° F. The atmospheric conditions are subject to sharp changes. At Erzincan, which has an elevation of 4,750 feet, the night temperatures of 40.6° F. are raised during the day time to 91.5° F., and at Erzurum during August the night temperatures are 39.2° and the day temperatures 87° F.

The amount of rainfall depends upon the elevation and varies from 14 to 32 inches. Table XIII shows the seasonal rainfall at several places on the plains. It will be noted that the rainfall is distributed through the year.

Table XIII.--Seasonal rainfall in eastern mountain region

Location	Rainfall in inches				
	Spring	Summer	Fall	Winter	Total Amount
Erzincan	4.25	1.80	1.86	4.10	12.01
Gumushane	3.66	2.22	2.48	3.00	11.36
Erzurum	4.00	2.30	2.08	3.31	11.69

SOILS OF ASIA MINOR

The soils of Asia Minor are unclassified and there are no available data regarding the physical and chemical condition of the soils. Consequently we are depending upon our original observation and experimentation for our discussion of this subject.

No doubt there are wide physical and chemical differences in the soils because of the mountainous character of the topography. But aside from this consideration, we can classify the soils of Asia Minor in general under two heads, according to the effect of climate. Thus we have soils of the (1) dry plateau or arid section and (2) of the seashore.

According to the Russian pedagogist, K. D. Glinka, the soils of Asia Minor are classified as those of red and grey soil regions, such as in Persia and Turkestan, because precipitation causes a difference in the character of the soil. We have observed red and grey soils on the arid Anatolian plateaus and have had opportunity to study their profiles.

An orographical characteristic of Anatolia is the large steppes and plains interspersed everywhere with mountainous ridges.

Soils of the Dry Plateau

Grey soils. The grey soils occupy a large area of the arid plateau and the eastern mountain region. They have developed under limited rainfall conditions and originated from various rocks. The productivity of these soils in turn varies with the nature of the parent rock. For example, in the northwestern plateau, they originated from cretaceous limestone or Jurrassic gypsum. They are frequently merely soils and are well adapted for wheat production. Other soils originated from gneiss shale and where this is the case the soils are very heavy and unadapted for dry farming.

The surface soil is greyish and in some cases a hard-pan occurs at a depth of 1.5 to 3 feet, depending upon the penetration of rainfall. This hard-pan layer may be light in color because it contains more carbonate material. The subsoil has more color than this hard-pan layer.

The sinking of an artesian well afforded opportunity to study the profile of one of these grey soils near Ankara. This soil lies on a deep shale mass which may be laminated with layers of gravel. The physical analysis of this soil at Akimesut near Ankara is shown in Table XIV. According to Dr. K. D. Glinka, the grey soils of his description have an analysis as specified in Table XV.

Table XIV.--Physical analysis of a grey soil at Akimesut

Depth	Percentage composition Size of particles in m. m.						
	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-.01	.01
c.M	M.M	M.M	M.M	M.M	M.M	M.M	M.M
0--15	1.50	3.22	6.18	2.40	20.40	22.50	42.60
15--25	0.22	2.00	7.28	5.50	19.42	21.02	45.56
25--75	0.06	0.10	4.54	5.60	16.56	25.90	43.24
150--175	---	0.02	0.15	10.33	19.50	29.75	40.25

Table XV.--Physical analyses of a grey soil according to Dr. K. D. Glinka

Depth c.m.	Percentage composition Size of particles in M. m.					
	1-2	1-0.5	0.5-.25	.25-05	05-.01	Less than .01
0-7	0	0.06	0.04	19.15	33.04	47.71
12-26	0	0.01	0.02	19.60	33.01	47.70
30-60	0	0.06	0.02	14.77	35.47	49.08
103-110	0	0.02	0.02	27.57	31.39	40.50
172-180	0	0	0.01	17.32	40.85	41.82

The physical analyses in these two tables show a close similarity. The adaptability of the grey soils to wheat production is very important. The small colloidal particles of this soil may play an important role in crop production under dry farming conditions. The heavy nature of the soil is caused by a high colloidal condition which occasions a high wilting point for the soil. Hence in dry years crops on these soils may suffer from drought. The heavy types of these grey soils usually occupy bottoms and level valleys.

The Asia Minor farmer frequently puts slopes under cultivation because with this topography there is good condition of drainage and the soils are lighter in structure. During wet years the bottom lands are more productive than the slopes. The heavy valley soils produce vigorous plants in the spring without irrigation when moisture conditions are favorable. Experiments in the use of fertilizers show that applications of nitrogenous fertilizers produce a growth response. The soils, being derived from cretaceous limestones, contain a goodly supply of potash, phosphorus, and calcium.

The cretaceous soils do not contain alkali. This is the case in the valley of the Yesil which is used for irrigation. If the grey soils originate from shale or trachyt, then alkali may appear in spots, such as in the Sakaria valley of the central plateau.

Red soils. Red colored soils are found everywhere in Anatolia. Sometimes the shade is chestnut brown, pinkish, or yellowish red, depending upon the parent rocks and humus content, and upon the climatical and topogfaphical position. On the dry plateau the soils are usually the same red color, which is a light red.

Asia Minor has a large area of soils that originated from trachyt rocks. These are mostly in the eastern mountain section, although trachyt layers occur in the tertiary formations. Trachyt is a rough rock which weathers easily and frequently gives rise to red soils because it contains large amounts of Fe_2O_3 and F_2O. This red color prevails in all soils under various climatical conditions. Trachyts also contain considerable alkali elements. This is shown by the following analysis of a trachyt rock, expressed in percentage composition:

S_2O_2,	Al_2O_2,	Fe_2O_3,	FeO,	MgO,	CaO,	Na_2O,	K_2O,	H_2O
66.06	16.45	2.25	5.01	0.19	0.79	7.57	5.52	0.62

Trachyts do not occur in the United States except in small isolated places, but in Asia Minor they are widely scattered. They are volcanic rocks that formed during at close of the tertiary period.

The Kizil river flows through a bed of trachyt and takes its name from the red color of the stream. The waters are alkaline. Profiles of two red soils have been examined and their physical and chemical analyses are shown in Table XVI and Table XVII.

Table XVI.---Gazi farm (Angora) soil physical analysis (red soil)

Depth	Percentage composition Size of particles				
	2-1 mm	1-0.5 mm	0.5-0.25 mm	0.25-0.01 mm	0.01 mm
0-15	1.8	7.2	19.4	41.6	30.00
15-25	0.30	6.18	21.22	37.50	34.60
25-73	----	6.50	20.20	38.18	35.12

Table XVII.--Gazi farm soil chemical analysis (red soil)

Depth	Percentage composition							
	SiO_2	AL_2O_3	F_2O_3	CaO	MgO	K_2O	Na_2O	P_2O_3
0-15	70.14	12.15	6.24	3.17	2.54	1.86	2.80	0.135
25-75	72.00	12.40	6.00	3.50	2.05	1.50	2.00	0.135

The texture of this soil is lighter than that of the grey soils. In some cases they form a layer only a foot deep on tertiary gravel. In other cases they are mixed with sand and gravel and are then unproductive desert soils in the dry plateau. In still other places the soils may be deep and are then productive under dry land agricultural management. However, the soils are subject to alkali spots on sloping areas that receive seepage. All streams flowing through trachyt soils contain some alkaline water, especially NaCl and Na_2So_4.

Level valleys in the red soil region produce good crops without irrigation, but if the year is exceptionally dry, the late drought is injurious because the soil moisture becomes more concentrated with the alkali salts. The farmers fear to irrigate these fields because they believe if once irrigated they must be watered every year, otherwise the alkali increases due to evaporation of larger volumes of water bringing the salts to the surface. It has been observed that farmers crop only the slopes in red land areas, and leave the bottomlands for grass and grazing.

Profiles of the red soils have been examined at many places. The surface soil is red and the subsoil a lighter red. The texture is uniform to a depth of 10 feet. The soil cracks widely and deeply through the A and B horizons.

Hard-pan layers do not appear in these soils. But below the B horizon there are sometimes white spots and strips of calcium. These spots may occur at depths of three feet or more, depending upon the penetration of rainfall.

The character of rainfall largely determines the occurrence of hard-pan. During the rainy season on the arid Asia Minor plateau, the moisture completely fills the upper surface pores. Most of the rain comes in small amounts during the winter and very little is lost by evaporation. When moisture in the form of films about the soil particles moves downward slowly, the finer particles of soil are not carried with this movement and no hard-pan develops. But in sandy soils, fine particles are easily carried down and the deposit of these fewer particles at the depth of moisture penetration causes the development of hard-pan.

The comparative nutritive elements in grey and red soils are shown in Table XVIII.

Table XVIII.--Nutritive elements in plateau soils

Location	Depth c.m.	Organic Matter	N	P_2O_5	K_2O	CaO
Akimesut red soil	0-15	1.15	.120	.042	2.15	.67
	15-25	0.90	.095	.045	2.00	.90
	25-50	0.85	.087	.036	2.09	1.25
Polatly grey soil	0-15	1.39	.125	.050	2.30	.93
	15-25	1.00	.092	.050	2.20	1.22
	25-50	0.98	.092	.060	2.22	1.58
Ayas sandy red soil	0-15	0.96	.103	.041	1.79	0.73
	18-25	0.90	.095	.039	1.80	0.57
	25-50	0.65	.078	.030	1.77	1.36

In considering the nitrogen data of Table XVIII, attention should be called to the fact that at Akimesut and Polatly the soil samples were taken on wheat land where raker threshing machines were used, and at Ayas the wheat had been harvested by ordinary methods. By this latter practise all of the straw is removed. This difference in the harvesting methods would alter the amount of straw returned to the soil and may account for the lower nitrogen content of the soils at Ayas. It is very evident that the red soils are much lower in calcium in the surface than the grey soils. The soil at Ayas is a sandy red soil, formed from the tertiary deposits of trachyt.

The soils of the Konia plain on the dry plateau are clay and silt loam. In color they are greyish brown or reddish brown. They are derived from tertiary fresh water lakes and can be compared with the soils of the Great Basin region in the United States. It is believed that wind played a part in the development of the Konia plain soils because the surface layer is laminated in some places to a depth of one foot with loess material.

Sea Shore Climate Soils

The Black sea area. The Black sea is of mountainous character and agriculturally is not important. Most of the area is occupied by forests. The soil originated from limestone. Because of erosion, much attention is given to terracing where fruit orchards are grown. All of the area under cultivation is terraced. The valleys are fertile and produce apples as well as other fruits.

Some mention should be made here of the famous Samson-Baffa tobacco region on this seashore. Tobacco seems to prefer the soil of this region, producing leaves of very fine quality. The tobacco soils have a reddish brown surface and light colored, well drained subsoil. Some localities here produce a quality of tobacco leaf which merits a high price and it would be of much interest to find out what soil condition produces this quality.

In general all of the Black seashore comprises forested areas and although the soil is fertile there is insufficient level land for cultural purposes. The exceptions are the river deltas. Only one, the Carsanbca plain in the Yesil, is large enough for crop production.

The Susirlik River Valley

The Susirlik river valley composes an extensive area south of the Marmora sea. Fertile alluvial silt loams predominate. In some parts the soils are very deep and in other parts they are sandy or gravelly. In some cases the soil is composed of a thin silty layer on a gravelly substratum. The Susirlik river has many branches that are still active in soil formation. They come down from the high forested elevations and during floods each year bring down deposits of silt which are spread over the large level lands.

The Smyrna Region

The Smyrna territory has a characteristic agriculture. The soil is very fertile and produces the famous Sultana seedless raisins, the Smyrna fig, and a fine aromatic tobacco. Perhaps the climate is effective but without doubt the soil is also a factor. The latter is chestnut colored and is derived from coniferous limestones belonging to the Devonian formations of the Paleozoic period. This type of soil also occurs in the Malatia region of the Euphrates valley and is likewise very fertile.

The Adana Plain Alluvial Soil

The Adana plain has been formed from soil of the Taurus mountains brought down by the Seyhan, Ceyhan rivers. Two thousand years ago during Strabo's time the Mediterranean sea was near the old and large Tarsus city. Today the sea is about 30 miles away. The soil is a very fine silt loam. Alkali appears in places because the subsurface sea water may rise to the surface under conditions of excessive evaporation.

THE ALKALI PROBLEM IN ASIA MINOR

In the irrigated sections, an important agricultural problem is the increasing accumulation of alkali. Old fields once productive are now barren. The alkali salts are sodium chloride and sodium sulphate. In small areas there is black alkali, sodium carbonate. The sodium has originated from trachyt which contains 7.57 per cent Na_2O. This rock as heretofore mentioned is abundant on the dry plateau, hence all streams of the plateau carry varying amounts of alkali salts. Table XIX gives a comparison between alkaline streams in Asia Minor and in the United States, including a non-alkaline river.

Most of the alkali on cultivated land occurs in spots and if moisture conditions are favorable, good crops are produced. There are, however, large areas of alkali land that produce only salt weeds. In the summer time these areas are covered with a white crustation. We have not observed how deep the alkali extends, but we believe that it is limited by the depth of penetration of moisture. Sodium chloride ions are absorbed in small amounts by the soil. On the other hand the alkali condition may be due to hillside seepage or on the deep alkali soils the origin may be the drying up of inland lakes such as is the case in the salt desert near

Table XIX.--Chemical analysis of alkaline streams in Asia Minor and the United States, with the St. Lawrence river for comparison

Ions	Parts per 100,000		
	Ankara irrigation water	St. Lawrence river	Price river, Utah
Ca	1.36	3.1	12.4
Mg	0.70	1.0	8.8
SO_4	7.93	2.2	34.0
Cl	12.08	0.4	0.28
HCO_3	7.93	6.8	27.8
NO_3	trace	---	0.03
Total	29.08	14.8	43.31

the big Tuz-gol (salt lake). This lake has a high concentration of sodium chloride, amounting to 32.2 per cent.

Another salt lake west of Tuz-gol contains sulphates of magnesium and sodium.

These two lakes give an idea of the amount of salt accumulation in the plateau region. During the tertiary period, the plateau was a fresh water inland sea connected by straits with the tertiary Sarmatian sea from which the present Caspine sea has been derived. The Caspine sea is not as salty as the Black sea but is salty enough. During long periods of evaporation the concentration of salts has increased. In the same manner the waters of the inland plateau lakes have become saturated with salts.

POTASSIUM NITRATE ACCUMULATION

In the Konia plain there are peculiar accumulations of alkali salts. When these salts are washed, potassium nitrate is extracted upon evaporation. This salt is used for the manufacture of black gunpowder. The salt occurs in spots on wet ground and is similar to the nitrate spots in Colorado of the United States. The Colorado salts in such instances are sodium nitrate rather than potassium nitrate.

We know but little about this alkali accumulation. It may be due to seepage because the spots do not occur in all wet soil and it is true that some of the dry plateau streams carry small amounts of nitrate salts.

THE DISTRIBUTION OF VEGETATION IN ASIA MINOR

The vegetation of Asia Minor has been studied on the basis of plant geography, thus we must consider three sections, namely, the interior plateau, the seashores, and the forests of Asia Minor. Although climate, elevation, and the parent rocks of soils affect plant distribution, we are unable to discuss peculiar plant distribution from this viewpoint, because the flora of Asia Minor is unclassified. Our knowledge of the subject is based upon the motif of economically important plants and upon the dominant species for the various regions.

THE FORESTS

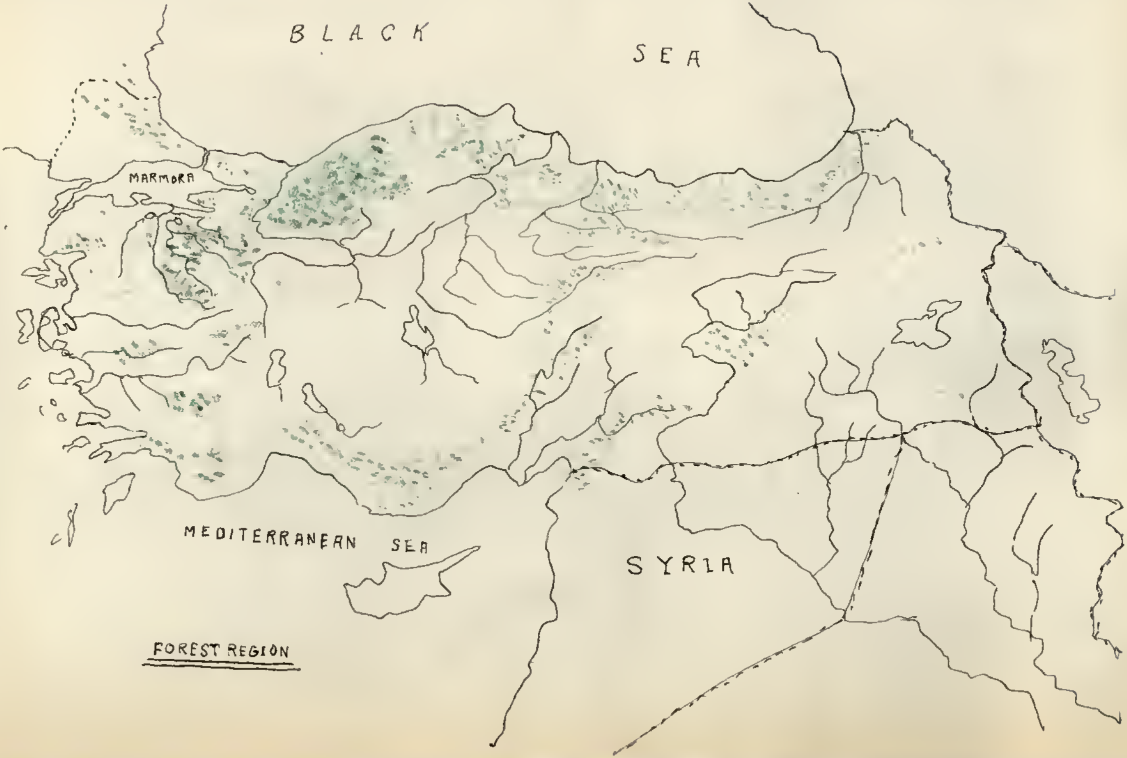
Forests cover about 10 per cent of Asia Minor. They include 25 species of economically important large trees that have been estimated in the following proportion:

Species	Per Cent
Pines (pinus silvestris (" communis	36.69
Oak, quercus pedunculata	13.72
Hornbeam, fagus silvatica	11.19
Fir and cedar, abies and cedrus libanis	9.64
Beech, carpinus betulus	5.06

Holly, aquifolium	3.67
Cistus, cistus silicastrum	2.90
Juniper, juniperus communis	1.53
Turpentine	1.44
Poplar, populus pramidalis	1.30
Olive, oliva Europea	1.21
Chestnut, castana sativa	1.14
Elm, elums glabra	1.14
Ash, fraxinus excelsior	.97
Valonia oak, quercus aegilops	.83
Plane tree, platanus orientalis	.79
Cypress, cupresus premidalis	7.64
Alder, alnus glutinosa	
Linden, tilia Europea	
Birch, betula alba	

Three fourths of the forest land is located near the Black seashores in a belt about 100 miles wide. The northwestern section especially is densely timbered. This locality is called the sea of trees. Other forested areas are the southern section of the sea of Marmora and the mountainous region between western Anatolia, the dry plateau, and the Taurus mountains. Figure 3 illustrates the distribution of the forest areas.

DISTRIBUTION OF FORESTS IN ASIA - MINOR



The Dry Plateau Region Vegetation

The dry plateau region is both treeless and scrubless. In passing from the humid regions to the dry plateau the vegetation becomes gradually smaller until there are no scrubs. As an example of this transition we can cite the vegetation between the Black seashore and the plateau. The Kizil Irmak river flows from the plateau to the Black sea. On both sides of this river, between the sea and the plateau, there is Berberis vulgaris, Juniperus communis, and some mixed scrub growth of pine and oak. There is not a grass sod on the dry plateau as in the Great Plains of the United States, except in bottom lands. This is due to scarcity of rain. The grass is of the bunch type.

There are many kinds of grasses on the plateau. Ephemeral dicotiledon is abundant during the spring rainy season. It grows rapidly until June. Only May and June are the green months on the plateau. All kinds of wild flowers are then in bloom. The plains, slopes, and mountain sides are green. This is the happiest time of the year for all plant and animal life. From our agricultural viewpoint it is important to study only the plants that are capable of surviving after June.

The central Anatolian plateau is not covered with sagebrush as is the Great Basin, U. S. A., but we find artemi-

Table XX.--Chemical analysis of irrigation waters of Asia Minor and of the United States

Salts	Parts per 100,000		
	Ankara	Price river, Utah	Emery creek, Utah
$CaSO_4$	3.19	11.2	---
$Ca(HCO_3)_6$	9.66	37.0	25.1
$MgSO_4$	---	43.5	5.1
$Mg(HCO_3)_2$	---	---	6.6
$MgCl_2$	---	---	0.4
$NaNO_3$	---	0.2	0.3
Na_2SO_4	9.19	15.4	---
NaCl	19.92	0.5	---
$Fe(HCO_3)_2$	0.91	---	---
Total	42.88	126.0	38.8

sia austriaoa, which belongs to the sagebrush family, near river banks or alkali spots on fertile silty loams. Farmers use this plant as an indication of productive soils as is done in western United States.

Rolling virgin land is covered on sandy slopes with Thymus odoratissimum. It keeps alive during the dry periods, having a very small leaf surface and a deep rooting system. Another dominant and characteristic plant is Astragallus gumifera, which belongs to the leguminocea family. It grows on sand hills of tertiary deposits and other dry virgin land. The plant is deep rooted and has cottonized thorny leaves. The farmers of Asia Minor obtain a gum from the surface roots of this plant. This gum is the commercial gum tragacanth. The annual export of this gum amounts to 700,000 pounds. Of this amount 100,000 pounds are sent annually to the United States. Koppen used the name of Astragallus to typify the climate of this region, referring to it as an Astragallus climate.

Ruta montana, a half scrub, grows on the fertile plains. This plant has a large root storage system.

On summer fallowed fields there is found Russian thistle (Salisola kali), Kochia, and Bermuda grass (Cynadan dactylan). Various Chenopodiacea and Amaranthacea that are resistant to alkali are found on irrigated fields.

Table XXI.--Chemical analysis of soils in alkali plateau of Asia Minor and in alkali regions of the United States

Salts	Parts per 100,000		
	Ankara	Colorado	Yuma, Arizona
$CaSO_4$	3.45	21.5	6.6
$Ca(HCO_3)_2$	6.50	----	----
$MgCl_2$	----	12.7	7.7
KCl	----	1.6	4.0
$MgSO_4$	4.20	----	----
$NaCl$	71.0	6.6	81.1
Na_2SO_4	12.4	----	----
$Na(HCO_3)_2$	2.00	----	8.3
$NaNO_3$	0.45	33.1	----
$CaCl_2$	----	17.3	----

The wellow tree is the only shade tree on the dry plateau. It grows near rivers and small streams. The Tamarix grows three to four feet high on sandy river bottoms. Gardens and vineyards are protected about the edges by the Russian olive. It is the most drought resistant deciduous tree in this climate. The elm, ulmus glaberea, grows as a shrub or individual local tree. The black locust has been introduced and is at present the only street and ornamental tree.

Golden yellow, purple, and pink crocuses, and white flowered Galeca are the first plants to bloom in the spring (February and March). These are all bulbiferous plants.

It will be important to study root systems of drought resistant plants on the dry plateau. Weaver of Nebraska, U. S. A., and other investigators in Arizona, U. S. A., have found a relation between amount of rainfall and root character. In the Great Plains of the United States, shallow rooted plants develop because the rainfall occurs during the summer in the form of showers. In Asia Minor there is winter rainfall that comes slowly and is all absorbed, penetrating the soil deeply. Hence in Asia Minor the plants that survive the summer are deep rooted. In like manner the weeds on summer fallowed land are deep rooted, such as Bermuda grass, Camel thistle (Synara cardunculus), and Boraginaceous plants.

On the east side of the Kizil Irmak river, on the plateau, there are local forests, consisting of coniferous trees, such as Pinus silvestris, and Juniperus communis. All cities and villages on the plateau have vineyards and fruit gardens close to the villages on the slopes. They produce nice grapes without irrigation. The grape is very drought resistant. The pear, apricot, cherry, almond, and wild pear grow well and produce delightful fruits.

Twenty five to 30 years ago, these kinds of dry plateau gardens produced an economic dryland plant, Rhamus cathartica. It has yellow cehery berries. The plant is a hardy shrub and now grows in wild form. A vegetable dye was formerly prepared from these berries which was used in dying Turkish rugs or carpets. At the present time German anilin dyes are used. Another economic plant is Prunus mahalep, which grows wild near Amasia in the eastern plateau. This wild cherry's nuts are sent abroad for use in pastry making, especially to Egypt.

SEA SHORE CLIMATE VEGETATION

Mediterranean evergreen trees and shrubs are characteristic of all the sea climates. Wild olives cover the slopes as far away as 50 miles from the sea. Evonimus nana and Buxus grow very extensively. The hazelnut (Coryllus avellana) produces excellent crops on the Black seashore. At

Kiresan the finest hazelnuts in the world are produced. Turkey exports yearly 13,000 metric tons of hazelnuts. Forty per cent of the shelled filberts used in the United States are imported from Turkey. Wild forms of coryllus are found everywhere in the seashore climates.

On the coast of the Marmora and Aegean seas, there are abundant growths of the olive tree (Olea Europea). Turkey produces 4,530,000 gallons of olive oil annually. Some of the small streams in the forests are bordered with Nerium oleander. Numerous Mediterranean evergreens abound such as, Ilex aquifolium, Arctostaphrylos uva ursis, Vaccinium myrtillus, vitis idaea, and Arbutus unedo.

Some of the forests and shrub lands have a dominant subtree, Cornus mascula. The mountains are covered with the several colored flowered cistus and an evergreen subshrub, Ruscus, belonging to the Lillacea family.

Vitex agnus castus, belonging to the Verbenacea family, is a distinguished shrub in the river bottom lands and vicinities. Paliurus palestris, Rhamnacea family, is a predominate plant everywhere on slopes and bottoms, rocky or sandy soil. Turkish farmers use this plant as protective fences about yards, gardens, and fields.

Crataegus oxyncanta, Prunus spinosa, wild roses , are extensively growing plants. Irrigation ditches limit the growth of Rubus fructicosae. Tamarixes and various varieties of the willow tree are found in the river and stream bottoms, forming small forests.

Glycyrriza glabera (licorice) and Rubia tenctoria are industrial plants that are native to the region. The first one has kept its importance, as Turkey exports one million tons yearly to the United States. But Rubia, a dye plant, is not important today since the German analin dyes have supplanted its use in dry goods and rug wool dyeing.

The valinia tree is important because Turkey exports yearly 50,000 metric tons of valonia. This tree grows extensively in the Aegean sea region.

The Taurus mountains have all the Mediterranean evergreens but the distinguished ones are cedar, Cedrus libanum, and Carob beans. In the Cilician plain the Tamarixes are vigorous-like trees. The cactus, Oponsia, and Agoves give a tropical aspect to this area.

EFFECT OF THREE TO FOUR THOUSAND YEARS OF CROPPING ON THE SOIL

Although the soils of Asia Minor have been cultivated for at least 40 centuries they are still productive. There are ancient cities established on the dry plateau in unknown times such as Kayseri, Ankara (ancient Anciry), and Amasia. The lands surrounding these cities must have been cultivated extensively because their inhabitants would need food. It is possible that these ancient cities did not have the same population that they have today and perhaps the land was not cropped as extensively as it is at the present time. But we can also refer to western Anatolia, to the Smyrna region, for example. In that region there are many cities that have disappeared and thus greater populations were supported than at the present time. Yet this area is still productive, and is considered the best soil in Asia Minor.

Apparently 40 centuries of cropping under the climatic conditions of Asia Minor has not exhausted the soil. Nitrogen which is always correlated with the degree of crop production is of atmospheric origin. Possibly the soil and climatic conditions have permitted free fixation of nitrogen to an extent that has sufficed for the cropping systems.

Since all the parent rocks contain much potassium, the soils supply of this element is very considerable.

There are extensive sources of lime, yet calcium is subject to leaching and chemical reaction. We have found that soil originating from cretaceous limestone did not contain enough calcium in the surface to establish alfalfa or sanfoin. For ordinary crop production we have not observed a calcium deficiency on the dry plateaus.

There are large areas in Asia Minor where the soils have been derived from volcanicrocks. Under this condition phosphorus deficiencies for crop production have been found. It is believed by some people that the stunted growth of animals in this region is due to a phosphorus deficiency in their feed. At the Ankara and Kepsud experimental stations, fertilizer tests have shown a lack of phosphorus in such soils.

On the dry plateau, the amount of organic matter in the soil is a very important problem. The nitrogen supply is associated with the amount of organic matter, since the bacteria responsible for free fixation of atmospheric nitrogen require carbonaceous material for their source of energy.

The Turkish dryland farmers have an established practise of resting their fields. By this resting method, time is allowed for the free fixation of nitrogen to take place. The nitrogen added to the soil by bacteria is not subject to leaching in the dry climate of the plateau.

The matter of returning straw to the soil is a grave problem in the plateau region. All straw is used for animal feeding on both the farms and in the cities. The ox and the donkey do not require a first-class forage. With some straw and outside grazing they can be sustained. Grain is only fed during their working periods. The easy sustenance of the ox and donkey may be the reason for their extensive use. In Asia Minor all animals except the small ones like sheep and goats require less than 20 pounds of straw daily.

AGRICULTURAL REGIONS OF ASIA MINOR

Division of Asia Minor into crop regions as the corn and cotton belts in the United States is a difficult matter. To begin with, Asia Minor is not such a large country as the United States. Then since primitive agricultural systems are still in use and with no transportation facilities, the farmers must produce for local consumption. It is necessary to produce everything that is needed in each locality. Accordingly unexpected crops are found in localities that are unadapted for that particular crop. For instance, cotton may be found at altitudes of 3,000 feet where the growing season is short. In such places, the season is so short in some years that the cotton bolls do not open, but the farmers harvest the unopened bolls. Fiber is obtained from them. It is necessary to produce cotton in order to provide family linen. There are many examples of this kind.

We have tried, regardless of the above difficulties, to classify Asia Minor on the basis of adaptability to agricultural crops of economic importance.

The Wheat Region

The climate of Asia Minor makes it possible to grow winter wheat, yet spring wheat is grown as well. The farmers sow large acreages of spring wheat in order to give a better distribution of labor and to escape some of the climatical difficulties. Although wheat is raised everywhere, we wish to call the wheat region, that section where the acreage is large and where wheat is produced for export from the locality. On this basis we have named the dry plateau the wheat region of Asia Minor. Ankara, Eskishehir, and Konia vilayets (Turkish political division name) are all located upon the dry plateau. They produce and export large amounts of wheat for the densely populated regions of western Anatolia and of Constantinople. In the eastern Kizil Irmak river region, Corum, Amasia, Yozgad, and Sivas vilayets produce much wheat for consumption in Black seashore regions which are densely populated. The Black sea area is mountainous and thus does not have sufficient level land for the raising of wheat.

During a favorable year, Turkish wheat production amounts to 150 million bushels. More than one-half of this amount is produced in regions having deficient rainfall. The dry areas produce only wheat. As a nation, Turkey is not a wheat exporter. In dry years, she is obliged to import large amounts of wheat. In 1928, a dry year, Turkey imported about 10 million bushels from abroad, largely from the United States.

Turkey has a population of 14 million people. They are large consumers of bread, using twice the per capita consumption of the United States. For each person among Anatolian farmers, three pounds of bread are consumed in addition to dishes and cookies that are made from wheat flour. In the United States one pound of wheat is used daily per person, including all kinds of food in which wheat products are used.

All Mediterranean countries are ideal wheat producing areas, because the winter and spring are moist and the summer very dry. On the dry plateau, with a 10-inch precipitation, 20 bushels of wheat per acre are produced, if the rains are well distributed. There is a close correlation between spring rainfall and the amount of wheat produced.

One difficulty in winter wheat production is that the fall rains may be late in coming. This fact limits the saving of winter wheat because farmers fear to plant a large acreage. Should there be continued dry weather after a small rain, the results are destructive conditions to the newly germinated seedlings. Consequently, the farmers of Asia Minor plant one-half or one-third of their acreage to spring wheat. Spring wheat gives a good yield.

There are two critical periods for wheat production in Asia Minor, the fall and the spring. A moist seed bed is needed in the fall, and in the spring the rains should be well distributed. The spring rainfall must be greater than

3.5 inches. The normal rainfall at this time is 5.39 inches.

Other Small Grains

The second important small grain in Asia Minor is barley. This crop is produced on the dry plateau and on the sea plains. Before the world war, Turkey exported barley, particularly to England and Germany. The latter country used barley in the manufacture of beer.

Oats and rye are not imprrtant crops in Asia Minor.

Cotton Region

Below a latitude of 40°, Asia Minor raises cotton successfully in the regions of the Aegean and Mediterranean seas. The yearly production is between 100,000 and 150,000 bales. Especially in recent years the Anatolian cotton belt farmers have flourished and production has increased. All kinds of American machinery have been introduced until the Adana plain now looks like a section of the Texas cotton country.

There are two cotton sections in Asia Minor. One in Cilicia (Adana plain) and one in the Smyrna region. Smyrna produces a better fiber than the Cilicia region. There are two limiting factors in cotton production, the matter of irrigation and the boll weevil.

The Mediterranean climate has but little summer rainfall and July and August rains are very effective on yield. Both Silicia and Smyrna have ample water sources. There are four large rivers in these regions. But capital has been lacking to finance irrigation projects. Eighty-five million dollars is needed for such projects. When the needed capital makes these irrigation projects possible, Asia Minor can produce more cotton and better cotton, similar in quality to that produced in Egypt.

Tobacco Region

Asia Minor produces a very famous tobacco and exports yearly 100 million pounds of cigarette leaf tobacco. In 1924 the exports were 170 million pounds. The quality of the tobacco is more dependent on soil and climatic conditions than is the case with other crops. Only particular localities can produce tobacco. The quality of tobacco may depend upon some particular soil element.

There are two tobacco regions, one near Smyrna and one near Samson on the Black sea shore. Bafra produces the most aromatic tobacco. This tobacco has a small leaf three to four inches long and scales about 1,000 leaves to the pound. Usually the best tobacco is raised on slopes. Tobacco must be grown on well drained soils and prefers the red soils.

The amount of tobacco production is under governmental control, likewise the sale of raw tobacco and cigarette manufacture. It not controlled, farmers may increase production and the price falls. The Turkish tobacco raiser believes in producing only high priced excellent tobacco.

Opium Region

Asia Minor produces an unusual crop in regions of deficient rainfall, namely, the poppy for opium culture. This crop is unknown in the dryland regions of the United States. The dry farmers of Asia Minor produce yearly about 650,000 pounds of opium, high in morphine, on 200,000 acres of land. This amount is sometimes increased to one and one-half million pounds. There are three principal opium regions:

(1) *Afion Karahissar (western plateau).* This region produces a famous druggist opium that is well known on the English market. It contains 12 per cent morphine. The rainfall in this locality is 13 to 14 inches.

(2) *Tokat (eastern plateau).* The opium produced here has a high morphine content and is called "soft" opium on the English and world markets. This opium is used largely for smoking. The rainfall of this Tokat region is 14 to to 16 inches.

(3) *Malatya (southeastern plateau).* The opium of the Malatya region is of medium quality, being composed of mixtures of varieties grown in the two previously named

regions. It contains 11 to 12 per cent morphine. On the market it goes by the name Malatya opium.

Morphine is not used by the Turks for smoking purposes. There is not any control of opium culture. It is a profitable crop for the dryland farmers. The value of exports of this crop amounts to one and one-half million dollars.

The opium poppy is winter-hardy and early maturing. It requires dry weather at the time of ripening. When the heads are scratched with a knife, the milk flows. This milk must be gum-like before it is gathered. The setting of the gum requires 12 to 24 hours. Since the heads do not all ripen at the same time, the poppy fields are handled two or three times. The milking period lasts 15 to 25 days. Hot dry weather is quite essential for the harvesting period in poppy culture. Hailstorms at harvesting periods are destructive. Opium milk is lost when the poppy heads and other parts of the plant are injured with hail. Hail injury also prevents the harvesting of seed. Summer storms occur about the 24th of June (summer solstice) hence all poppy fields should be harvested before this date.

The poppy is usually sown in the winter and but seldom in the spring. The winter sowing is desirable because the spring sowing may be late in maturing. Conditions favorable for winter wheat are favorable for poppy production.

There would be many obstacles to poppy culture in the dryland regions of the United States. There would be summer rains, hail, destructive winter temperatures, and the lack of the hand labor which the poppy culture requires. The high morphined opium of Turkey is universally famous. Asia Minor offers climatic conditions that are particularly favorable for this crop, just as is the case with the Smyrna fig, Sultana seedless grapes, and Angora goat. In no other place are these produced as in Asia Minor.

The dryland farmers of Asia Minor use a rotation of poppy and wheat. The poppy is sown on fallow and the second crop is wheat. The poppy is taken from the field early and it is a cultivated crop. A well prepared fallow yields eight pounds of opium and about 500 pounds of poppy seeds. The seeds contain 45 per cent oil from which 35 per cent of poppy oil is extracted by ordinary methods. This oil, like olive oil, is used for cooking purposes by the people of the opium regions and is preferred by them. After the oil is extracted, the "cake" is used for feeding dairy animals and is fed especially to the water buffalo cows. If fed poppy cake, the animals produce one pound of butterfat for every 10 pounds of milk. The dry poppy stems are used for firewood because of the scarcity of fuel.

Rice Region

Rice is one of the important foods in Asia Minor and is a profitable crop for the Anatolian farmer. Rice culture prevails on all the irrigated land. The yearly production is one and one-half million bushels. This is not enough to supply the amount consumed, hence Turkey imports rice from abroad.

Rice is produced in three special regions: in (1) Brussa (near Marmora sea), in (2) Tosya, Beypazar Amasia (northern plateau), and (3) in the southwestern territory. In Asia Minor, rice ripens in 100 days. Rice culture extends farther north than cotton culture. To produce rice, three summer months with temperatures not much above 70° F. are required. There is a future for rice culture because of the high local consumption.

At the present time, malaria is associated with rice culture because the irrigation systems are not well constructed. The Turkish department of agriculture is giving attention to rice production and two rice centers have recently been provided with good mills.

Sesam Region

Sesam, an oleoginous plant of the Pedaliacea family, is raised extensively in some localities. It is consumed for local needs and also exported abroad. Sesam prefers a hot growing season, yet can be raised in regions where the cotton bolls do not open. The plant is drought resistant.

In the Asia Minor cotton belt Sesam is sown on the same fields with cotton. This is done especially when the weather is cool after the cotton has been planted or when continuous rains prevent a good stand of cotton. Both crops grow, but the Sesam is the first to ripen. It matures in two and one-half months between seeding and harvesting time. The seed is sown late (in June) because late frosts and cool weather are injurious. Sesam gives the farmer the last chance for a crop during the summer season. If good stands are not secured with other crops then Sesam is planted. Sesam seed germinates rapidly. If the seed bed remains moist for two or three days, a good stand can be obtained. There is a rural proverb which states: "If Sesam seed is not ashamed, it tries to germinate in the farmer's shoes." The seed of Sesam contains 45 per cent of oil which is used for cooking like poppy and olive oil. It is used extensively for making Helva, a Turkish sweet-meat. Turkey produces annually 10 million pounds of Sesam seed on one-half million acres.

Corn, Durra, Millet Region

Corn is raised in all of the seashore regions and about some villages on the dry plateau at an elevation of 3,500 feet. In the latter place the corn is a short stalked variety. After wheat and barley, corn is third largest crop in Turkey. In favorable years the corn production on two million acres is 20 to 25 million bushels. In some places the corn is irrigated. In the fertile alluvial soils of the Marmora sea region where irrigation is used, the farmers harvest two crops per season. Barley is harvested early, then tilled and planted immediately to corn.

Durra is raised in southeastern Anatolia, but not extensively. Summer drought prevents the cultivation of this crop.

Millet is the oldest crop in Asia Minor, growing successfully in the southeastern dry region. The production of millet increases when the locusts become destructive to earlier crops. Southeastern Anatolia is exposed every year to depredation by grasshoppers. Annually the desert sends out millions of them to eat upon the cropped land. They destroy all vegetation. The Turkish department of agriculture maintains an organization to combat grasshoppers.

Millet has been grown in Asia Minor since ancient times. Warehouses in old forts have been found containing millet which had been stored two thousand years ago or perhaps more. Strabo mentioned in his book that millet was grown extensively and successfully on the dry plateau.

Leguminous Crop Regions

It is impossible to define a special region for leguminous crops. They grow everywhere. There are two leguminous crops which are not grown in the United States; these are the chick pea, Cicer Arietinum, and Burçak, Ervium Ervilia. The leguminous crop acreage is as follows:

Species	Acreage
Vicia faba	42,000
Chick pea	120,000
Beans	109,000
Lentils	65,000
Ervum Ervilia	140,000
Total	476,700

Burçak, Ervum Ervilia, is a good food for working animals, because of its nitrogenous character. The chick pea is a dryland human food, used especially by farmers during the winter time. All of these plants are raised under dryland conditions since they are early ripening plants. When these legumes are grown in a wheat rotation, the wheat can be raised without summer fallow.

The Burçak and chick pea are especially well adapted for the dryland plateau. They grow successfully and leave the ground in excellent condition for succeeding crops. The difficulty of harvesting is the one thing that limits their production. The farmers of Asia Minor harvest leguminous crops by hand and thus pull the crop by hand. These legumes are usually planted in the spring. Vicia faba is planted earlier than other winter crops but when sown in the early fall in dry seed beds it is difficult to obtain a stand.

NITROGEN PROBLEM AND LEGUMINOUS CROPS IN ROTATION

Winter and spring rainfall conditions are ideal for small grain production. However, under dryland conditions there are two limiting factors: (1) moisture and (2) available nitrogen. In the dryland areas of Asia Minor it is possible to produce wheat without summer fallow if legumes are grown in rotation. This indicates that available nitrogen is of chief importance. There has not been a field investigation of this problem in Turkey, yet in practise large increases in crop yield have been obtained by this method. We have found, however, sources of information that apply to this question. The Moro experiment station, U. S. A., located in Columbia river basin dryland area, has conducted valuable observations upon the subject. This region is similar climatically to Asia Minor.

At Moro, Oregon, the amount of soil moisture under various cropping systems was investigated. Only 0.2 per cent more moisture was found in fallowed ground than in soil that had been cropped to Canadian peas. However, in yield, the spring wheat produced 24.7 bushels per acre in rotation after peas (average of 12 years) and 24.7 bushels with summer fallow. We can compare these results with winter wheat. Ordinary fallow methods produce an annual yield of 870 pounds while a wheat, Canadian peas, rotation produces 1,053 pounds. The only question is whether this difference is large enough to pay the cost of growing the peas. However, in the climate of Asia Minor with a spring type of rainfall nitrogen may be the limiting factor in crop production.

Reference may also be made to the results obtained at Lind, Washington, U. S. A., which is a drier region than Asia Minor. In studying the relation of moisture and available nitrogen to crop production, the following correlations during a dry year were found:

Coefficient of correlation between moisture and grain = .70 ± .06

Coefficient of correlation between moisture and straw = .51 ± .08

Coefficient of correlation between nitrate nigrogen and grain = .56 ± .08

Coefficient of correlation between nitrate nitrogen and straw = .57 ± .07

The annual rainfall at Lind, Washington, for the period 1919-1920 was 6.56 inches. We can conclude from the results obtained at this station that dryland farmers must give attention to the nitrogen problem which may be equally as important as the moisture problem.

Crop Varieties in Asia Minor

Wheat varieties. Wheat varieties have not been tested experimentally in Asia Minor. The varieties have local names and are classified on an economical basis, thus:

Turkish Name	English Name	Scientific Name
Sert	Hard	Durum
Beyaz	White soft	T. vulgare
Kizilca	Red soft	T. vulgare
Sunter	Hard red	T. vulgare

The high priced varieties are the soft white and red wheats. The imported American No. 2 hard red winter wheat is sold for the same price as these Turkish varieties. Durum and soft red bring a lower price, yet the Durum wheat is usually found on the market. Wheat breeding stations, since established, have been working with wheat selections but only with local varieties. We will discuss varieties which, our observation leads us to believe, has a bearing upon the wheat problem.

Kundulu Durum wheat. The dryland farmers of the Konia Ankara plains grow only Kundulu Durum. This wheat has a very large kernel and is extremely hard. It has the winter habit of being sown late, and when planted in March, for example, a small kernel is produced and does grow up straight like spring wheat. On irrigated land, Kundulu is sown early on most seed beds. Under this condition it tillers like common winter wheat. It differs from common wheat in its leaf character. The leaves are wide and light colored. It is probably as winter-hardy as common winter wheat. The plant and head characters are the same as Kubanka Durum in the United States. This wheat is characterized by a red colored head when the plant ripens, which can be distinguished at a great distance.

Under ordinary conditions, Kundulu Durum produces two to five tillers. In ordinary fields we have counted 45 to 65 kernels per head. Under the usual dryland conditions the heads contain an average of about 35 kernels.

The Turkish department of agriculture is giving attention to the use of farming and grading mills. These mills are in general use among the farmers. Since Kundulu has a large kernel, it is easily separated. With the use of the grading machines, the plateau farmers now grow pure Kundulu.

We do not have statistical data as to the acreage of the various varieties but we know that more than one-half of the wheat sold on the Constantinople market is Durum.

Durum and especially Kubanka is drought resistant. It suspends growth during dry periods. We do not know the origin of Durum in Asia Minor but it is an old wheat that probably came from Russia. Part of the Turkish population emigrated from the Crimea region and these people are successful wheat farmers on the dry plateau.

There is no rust problem in Asia Minor, perhaps because of the climatic conditions. The rains come late and early stands are not secured. The seed may remain until spring. Under such conditions good results are obtained with Durum wheat. In western Anatolia where the Hessian fly is destructive, farmers claim that the Durum is resistant to fly but we have made no observations of this fact.

Smut is the only important fungous disease on the Asia Minor plateau. Kundulu as well as soft types of wheat is susceptible to smut.

Durum is not a desirable wheat for the Turkish grain market. The millers and bakers want bread wheat and to obtain it, import wheat and flour from abroad. When Turkey was free to place import duties, she placed a high tariff on foreign wheat. But the Turkish people like white loaf bread. The Turkish farmers expect the plant breeders to give them a bread wheat which will grow as well as Durum on the dry plateau.

Kadirogle variety. Kadirogle is a soft white wheat that is grown extensively on the dryland as a spring wheat. It is awnless, has a stiff straw, and is taller than Durum. This wheat is not winter-hardy and not as productive as Durum on dryland. Under irrigation it produces high yields. The kernal is white, soft, and oval. The glumes and leaves are pubescent. It is always a desirable wheat on the market and sells one cent per kilogram higher than other wheats. It is grown only in the dry country. Farmers use this wheat for the second crop after summer fallow and sow it without much seed bed preparation. They sow it on the stubble and plow it under.

White headed Durum. White headed Durum is not grown extensively but it is a very distinctive wheat because of its white colored ripened heads with white chaff. The kernels are red, hard, and smaller than Kundulu. It is taller than Kundulu and the heads are more compact than other Durums. Like Kundulu, it is used as a winter wheat. But little smut has been found in this wheat. The tall straw of this wheat is desirable from the standpoint of harvesting and machinery. Its smut resistance is another important character. Thus this wheat may be of much value in obtaining by breeding, improved varieties. As yet the wheat has not been tested by progeny methods.

Blackhull Durum. The growth of Blackhull Durum tends to be limited to the mountainous regions. It is used as a spring wheat. This wheat has a dark colored chaff, black awns, and white kernels.

There are other Durum varieties such as the red chaffed Durum, which has hard white kernels, but all of them are unimportant.

Sunter

Common Turkey red hard winter varieties. On the Turkish grain market, all hard red winter varieties are called Sunter. These wheats grow everywhere under different names, especially in the seashore climates, due to there being sufficient early moisture for establishing growth before the winter cold.

The Asia Minor Blackhull wheat is similar to the Blackhull wheat which we have observed in Kansas. It has the same name in these two widely separated continents. The Turkish farmers call it Karakilçik, which means blackhull. This wheat grows in the mountainous country of western Anatolia.

Kizilica

Common soft red winter or spring variety. The Kizilica wheat grows in seashore climates, especially in the Mediterranean region. The kernels are very small, bright red, or dark red but never white.

In the above discussion of wheat varieties, we have tried to express our general knowledge of the varieties in Asia Minor. It has been a difficult task because it must be true that individual varieties have developed during the centuries that wheat has been grown. We believe that there is continual change in nature. After each change, more hardy plants develop. Wild rye, Aegelops ovata, emmer, spelt, many kinds of Durum and winter wheats, have been grown in about the same conditions. It is possible that crossing and mutations have occurred naturally.

Asia Minor has had different immigrations during its history, which have continued up to the present time. People have come from central Asia, Hungaria, the Russian steppes, and from the African desert. They all bring in new varieties of wheat when they emigrate to a new country. Under these conditions it is difficult to distinguish the original varieties that belong to the region. However, we are sure that continual research with this object in view will enable us to isolate the original varieties.

Varieties of Other Agricultural Crops

Barley. Asia Minor produces the best barley that is on the European market. Before the world war, there was considerable export of barley to England and Germany. The barleys are not classified as to variety and are called local names. There are two economic varieties, six row and two row barley. However, we have found in the United States two barleys that originated in Asia Minor, White Smyrna and Trebi.

The Smyrna region does not raise the two row barley but this famous beer barley was exported from the port of Smyrna. The white two row Smyrna barley is produced especially in Ankara, Eskisehir, Konia, and Usak, all dry plateau regions.

White Smyrna has not changed its characters in the transfer to the United States. They are the same as in its home.

There are other two rowed barleys in the plateau regions similar to Smyrna but having black kernels and winter habit of growth.

The Asia Minor farmers do not take much care in preparing barley seed beds. They sow barley on winter wheat stubble. Very often the barley is planted in fields near villages and upon which barnyard manure is spread. The black variety having the winter habit is not grown extensively by plateau farmers because winter wheat is the chief crop.

Both white and black Smyrna barleys are well adapted to dryland conditions, yet during the extremely dry years, barley is more subject to injury than wheat. Barley matures earlier and thus escapes the drought, but it is not sown on summer fallow; and for the reason that it is planted on manured fields, it is more apt to be injured during very dry years.

Barley does not have local variety names like wheat. It is named according to the number of rows or color of kernels. We do not know a Turkish name for white Smyrna barley.

Barley is the crop first sown in the fall by the farmers of Asia Minor. This is done in order that the plants may become deeply rooted and tillered before cold weather. Barley is easily injured by frost. In the dry plateau we have found a close relation between May rain and the barley crop.

Trebi, a six row barley, is the second American barley thaA originated in Asia Minor. This name was given it by the Cereal Office, Bureau of Plant Industry, United States Department of Agriculture. It is grown in the northeastern plateau region, particularly in Amasia Sivas province and in some eastern mountain valleys, where six row barley is produced under irrigation. We believe that the American Trebi originated in this province. Its parents are high yielding barleys under irrigation.

Barley is the second important crop in Asia Minor. Seven million acres are devoted to its culture. The average annual production is 95 million bushels.

Oat Varieties. Oats are not an important crop in Asia Minor because barley is used for feeding horses. Black oats are the exception to the lack of any local variety names for oats. However, all oats belong to a Mediterranean variety, Avena byzantina. In some places there is a white, side, oat, Avena orientalis, which came perhaps from Russian immigration.

Rice varieties. The rices are classified according to the color of chaff, color of stripes on the seed, or to economic value. All of them, however, are of the starchy type variety. There are three well known varieties: Redhull, Blackhull, and White. The White rice is the more highly priced, but the Redhull is the most productive, and cultivated the most extensively. All varieties bring a higher price on the market than American varieties.

We are not mentioning other crop varieties because their variety characteristics are unknown.

A WHEAT BREEDING PROGRAM FOR ASIA MINOR

Climate, soil, and conditions of social life, will always give wheat the first place in the agriculture of Asia Minor. The new Turkish government wishes to improve wheat culture in Turkey. A wheat program is needed that will be helpful to the Turkish farmers. We will try to outline a wheat program that is based upon our study in the United States.

Our big problem is drought. Moisture and nitrogen conservation methods must be shown to the farmers. On the other hand our national wheat problem involves the development of new varieties of bread wheats, that will equal or excel the productiveness of the present Durum.

The outline of our tentative wheat breeding program is as follows:

(1) A bread wheat variety that is hardy enough for the winters of Asia Minor. If it does not germinate during early winter, it must give a good stand and yield as does Durum.

(2) We need wheat with straw tall enough to be harvested with machinery.

(3) Varieties that are early and drought resistant, equal or superior to Durum in these characters.

(4) Breeding for resistance to smut. Smut is the only destructive disease in Asia Minor. Kundula or Kadiroglo are susceptible to this disease. We want to combine smut resistant characters with other desirable characters.

(5) Good quality. Breeding for high protein, high loaf volume, good texture, white flour, high test weight, and good yield, are all desirable. The Turkish baker mixes red hard wheat flour and white wheat flour in order to produce a white bread or cake. In our present varieties

we have some that contain these desirable characters individually but not collectively. Crossing is necessary in order to develop a wheat that may have all of them.

(6) A non-shattering wheat is needed because Asia Minor has a dry summer with a long harvesting period. The farmers are not generally equipped with modern machinery. It will be a difficult matter to equip all Turkish farmers with modern implements like the farmers of the United States. There are small acreages and separated fields, the country is not industrial, and the last but most important reason is that the Turkish farmers are poor. There is no material damage to learning the wheat standing until it is all harvested if we have a non-shattering type of wheat.

Durum, especially Kundulu, has this non-shattering character. Our demonstration farm near Ankara (belonging to Gazi) is well equipped with modern machinery, yet in some years we cannot harvest all wheat until September because of the large acreage. None the less, Kundulu wheat was not injured by this extension of the harvesting period.

Turkey has different climatic zones, yet the program we have outlined for the dry plateau is applicable and desirable for all localities.

We have not mentioned questions of farm storages, seed cleaning, seed treatment, and other important subjects, but have confined our discussion to the important wheat breeding program.

Turkey has three plant breeding stations in Asia Minor. They are located (1) in the dry plateau for small grain work; (2) in the cotton belt for cotton breeding; and (3) at Ada Bazar near Marmora region, for the improvement of potatoes and corn. The Turkish tobacco monopoly bureau maintains a tobacco breeding station. All of these stations are newly established.

FARMING CONDITIONS IN ASIA MINOR

The farmers of Asia Minor work with primitive tools and slow motive power, like the ox and water buffalo. Modern farm machinery and horses are used in the seashore regions and on a few of the large farms of the plateau. With these exceptions the farmers use wooden plows, sickles, hand sowing, and old wind threshing methods. The common vehicle is the very ancient two wheeled Kagni.

The rural people live in villages of 20 to 500 families. This custom originated in ancient times when it was necessary to protect the family from roving tribes. The water problem also necessitated village life. Many villages were established near springs. The plateau farmers do not have the telephone, electric light, parcel post, automobiles, and well developed highways, all of which are seen in the United States. We believe that the possession of these things has been respponsible for the prosperity of American farmers.

The Asia Minor farmers with oxen or buffalo plow approximately three-fourths of an acre per day. One pair of oxen prepare about 25 to 30 acres of summer fallow yearly. Since the fallow land is used for the next year's seeding, most farmers have but two pair of animals. Time is lost in going to and from the fields, perhaps two or three hours. Each farmer has different fields at different places.

Necessarily Turkey is an agricultural country, a producer of raw materials. The new Turkish leaders wish to change the primitive methods for scientific ones that may bring prosperity to the country. We need more scientific men and more experimentation. Our climate requires dry farming methods of crop production and our crops need improvement. The Turkish leader, Mustafa Kemal wishes to train me for this problem. He is rebuilding Turkey and wishes to be a demonstrator to his people. Mustafa Kemal has established four large farms in different places, all equipped with modern machinery,especially the Gazi modern farm near Ankara. This farm has 25,000 acres with 10,000 sheep including lambs. There are 2,500 to 3,000 acres under cultivation with modern machinery such as 16 tractors, one combine harvester, four separators, and other needed equipment. An attempt is made on this farm to demonstrate new things and to give improved clean seeds to the Turkish farmers.

METHODS OF FIELD MANAGEMENT IN ASIA MINOR

The field management of dry plateau farms presents problems that are quite foreign to agriculture in the United States. Land on the dry plateau is not fenced. The village herds graze together outside the village limitations. With this system much attention must be given to the livestock.

Communal farming and grazing methods prevail on the plateau. The villages prepare their land together. The pasture belongs to all of them. The hay is divided according to their particular rights. Where irrigation is practised, communal methods are employed for preparing ditches or rebuilding water wheels. Weekly water allotments may be sold; for example, a single field may have an allotment of 24 to 48 hours water supply.

The dry plateau farmers cultivate their fields five to 10 years, depending upon the fertility of the soil. Following this cultivation period the land is put to rest for an equal period. The climate and method of farming has not permitted the continuous cropping practise.

The dryland farmers use one year summer fallow and one or two years of cropping, depending upon the soil condition. Summer fallows are prepared in the early spring until the 24th of June. They know that early plowing is better than late plowing. Everywhere it is important to control weeds for moisture conservation. However, with a small summer rainfall there is not much weed growth.

Instead of cultivating fallowed land, the Asia Minor farmers on the dryland graze the fallow weeds with sheep. In the summer time some village animals are kept on the village grazing land, but the large flocks or herds are sent to higher grazing land. The weeds on summer fallow in Asia Minor do not grow vigorously as in the United States, because the summer is dry.

Seed is sown by hand on untilled fallow land and is then covered by shallow plowing. Thus the seed is deeply covered, to a depth of three or five inches. Very few farmers use drills for seeding. It is important that the seed be placed in the moist section of the soil or placed deep enough to protect it from germinating after small showers. Under these conditions, we believe that the furrow drill would be very useful, although it has not been tested. After the seed is covered with the plow it is the usual practise to use a leveler or roller. Spring crops are usually sown on the stubble. Asia Minor farmers use more seed per acre than American dryland farmers. This is because the Durum wheat kernel is larger, and the seeds being deeply covered, the poor seeds do not germinate.

The farmers count their yields by its multiple of the seed used. Thus a 10 to one yield means that one bushel of seed was sown per acre and 10 bushels were produced.

THE POSSIBLE ADAPTATION OF AMERICAN DRY-FARMING METHODS TO DRY-PLATEAU OF ASIA MINOR

Moisture conservation and nitrogen fixation are of primary importance in dry farming. These two factors are best obtained by timely tillage and by killing weeds.

The Asia Minor plateau climate is similar in many ways to the climate of the Great Plains and of the Columbia river basin in the United States. Experiment stations in these two regions have investigated the crop producing possibilities under various systems of cropping and management. From a study of the experimental results obtained, we believe the following soil management program will be valuable to the dryland farmers of Asia Minor:

(1) Every farmer should summer fallow an area equal to one third that in crop.

(2) Prepare the fallow as early as possible in the spring.

(3) Kill weeds by different methods.

(4) Plow shallow except for summer fallow. For summer fallow, plow five to seven inches deep in April, and keep

it clean with the duck foot cultivator. For the second or a third crop after fallow plowing may be shallow. The one way disk would be adaptable at this time. It is always important to consider the cost of production in relation to yield.

(5) The question of seeding in dry ground should be investigated. Data from Lind, Washington, U. S. A., indicate that nothing is gained by seeding in dry soil before the fall rains. The Asia Minor experiment stations should study this problem.

(6) The rate of seeding wheat can be reduced with the use of modern machinery and clean seed. One bushel of wheat per acre is sufficient for a good stand.

(7) The use of all straw and stubble should be changed. Thereby livestock could be fed rye or wheat hay, in order that more straw can be returned to the soil. The question of returning straw is associated with the problem of free fixation of nitrogen. The agricultural experiment stations of Asia Minor should carry on investigations involving the maintenance of organic matter and nitrogen under various methods of management.

The farmers of Asia Minor have used all straw for animal feeding. One-third of the cost of the crop production is secured from the value of the straw. During the winter of 1929, straw sold for three cents per kilogram on the Ankara market. Although straw is the principal source of organic matter, its economic value has precluded the return of straw to the soil.

Bibliography

(1) Ahmet Tevtik Meteorology, Constantinople, 1927

(2) Ahmet Malik, Geology, Constantinople, 1926

(3) Turkish Meteorological Institute, Monthly weather bulletins, Ankara, Turkey, 1926-1927

(4) Tchipatchep, Geologic Map of Asia Minor, 1867-1869

(5) G. Bie Rarendal, Turkey a Commercial and industrial handbook, Washington, D. C. 1926

(6) K. D. Glinka, The great soil groups of the world

(7) Experiments in wheat production on the dry lands of the western U. S. A., Washington, D. C., 1923 (Dept. of Agr. Bulletin No. 1173)

(8) M. A. McCall and H. M. Wanser, The principles of summer fallow tillage, Pullman, Washington, 1929

(9) D. E. Stephen, Dry farm crop rotation experiments at Moro, Oregon, Corvallis, Oregon, 1924

(10) F. J. Sievers and H. F. Holtz, The significance of nitrogen in soil organic matter relationships, Washington State Agricultural Experiment Station Bulletin 206, 1926

(11) Stewart, Robert, and C. T. Hirst, The alkali content of irrigation water, Utah Agricultural Experiment Station Bulletin 147, 1916